SPU – Investigations in String and Wind Instruments

**Station 1:**

Temperature inside cylinder: 21°C

Speed of sound inside the cylinder:

Vs = 331 m/s + (0.6 m/s/°C \*T)

Vs = 331 + (0.6 \*21)

Vs = 343.6 m/s

L1 = 0.39 m

L2 = 1.17 m

λ = L2 – L1

λ = 1.17 – 0.39

λ = 0.78 m/cycle

1/ λ = 1.28 cycles / m

V = 343.6 m/s

F = 1/ λ \* V

F = 1.28 cycles / m \* 343.6 m/s

F = 440 hz

Answer to:  *How you could still do this experiment if you had no thermometer, but you had one more tuning fork of a known frequency?*

If you take the frequency and the λ, frequency / 1/ λ = the speed of sound. So you have a known frequency, you can find your two notes to get λ, and then the known frequency, and divide that by 1/ λ, then you will find the speed of sound inside the tube. Take that, subtract 331, and divide by 0.6, and then you will find the temperature.

**Station 2:**

The answer is no, the sound will not be as loud because the temperature of the water affects the temperature of the air, which in turn affects the speed of sound in that air. The warmer the air, the faster the sound travels, and therefore the instruments tuned in one temperature will have to be retuned in different temperatures.

**Station 3:**

My hypothesis states that if the resonance tubes’ diameter is increased, then the resonant length will change. My results showed that this is not true because the width of the tube only affects the overall volume of the tuning fork, but it does not affect the resonance length. The only pieces of information that change the resonance frequency are temperature and the natural frequency of the tuning fork. Therefore we can reject my hypothesis.

**Station 4:**

A G F E D C B A

880Hz 698Hz 587Hz 494Hz 440Hz

784Hz 659Hz 523Hz

It’s a function of the tension in the string, and the weight of the string, since it cannot be a function of the length.

f α tension

f α weight (mass)

f α length (but not in this case)

*Safety Instructions*

The safety instructions I would give would be to be careful with the resonance tubes, as they are made out of glass and are easily broken. I would also warn students against the hot water of station #2, so that they do not burn themselves. Also, switching the tubes from one temperature bath to another is dangerous because the tubes can shatter as well.